Dividing (6) by (5), and reducing, we finally obtain $\tan\alpha = \mu'\tan\theta$.

From eq's (1) and (2), $\sin\theta = \mu R \div \mu' R'$ .. (7), $\cos\theta = (W-R)\div\mu' R'$. (8)
Hence $\tan\alpha = \mu'\mu R \div (W-R)$, and therefore

$$\sin\alpha = \frac{\mu'\mu R}{[(W-R)^2+(\mu'\mu R)^2]^{\frac{1}{2}}} \;..(9),\quad \cos\alpha = \frac{W-R}{[(W-R)^2+(\mu'\mu R)^2]^{\frac{1}{2}}}. \quad (10)$$

The substitution of (8) in (5) gives

$$W\,\frac{W-R}{\mu' R'} = 2\mu' R', \;\therefore\; W-R = \frac{2(\mu' R')^2}{W} \;..(11), \text{ and } R = \frac{W^2-2(\mu' R')^2}{W}$$

In (6), substitute the values of $\sin\theta$, $\cos\theta$, $\sin\alpha$, $\cos\alpha$, as found in (7), (8), (9) and (10) and reduce; then

$$W(W-R) = 2\mu^2R^2 + 2(W-R)^2. \quad (13)$$

By means of (11) and (12), equation (13) becomes

$$2(\mu' R')^2 = 2\mu^2\left(\frac{W^2-2(\mu' R')^2}{W}\right)^2 + \frac{8(\mu' R')^4}{W^2}, \text{ which reduces to}$$

$$R'^4 - \frac{(4\mu^2+1)W^2}{4\mu'^2(\mu+1)}R'^2 = -\frac{\mu^2W^4}{4\mu'^4(\mu^2+1)}. \quad (14)$$

The resolution of equation (14) gives

$$R' = \pm\frac{W}{2\mu'}\left[\frac{(4\mu+1)\mp(1-8\mu^2)^{\frac{1}{2}}}{2(\mu^2+1)}\right]^{\frac{1}{2}}.$$

This value of the reaction of the vertical plane, substituted in (12) determines the reaction of the horizontal plane, and by means of these values and the given coeffi's μ' and μ, the angles α and θ can be readily found.

PROBLEMS.

196. By P. M. Mc. Kay, Looxahoma, Miss.—The sides of a triangle are respectively x^2+x+1, $2x+1$ and x^2-1, x being any number greater than one; prove that the angle opposite the side x^2+x+1 is equal to 120°.

197. By Lieut. Fred. Schwatka, Spotted Tail Ag'y, D. T.—*AB* is the diameter of a circle whose center is *C*, *D* is the middle point of *CB*, and is the center of a circle whose diameter is *CB*, and *E* is the middle p't of *AC*. *EF* is perp. to *AB* and intersects the circle *C* in *F*, and *EG* is tangent to the circle *D* at *G*. Prove that *EFG* is an equilateral triangle.

198. By Artemas Martin, M. A., Erie, Pa.—Find the average dist. between two points taken at random in the surface of a rectan., sides *a* & *b*.

199. By Amateur.— Find an infinite series the sum of which is a square,—the sum of *n* terms of which is a square,—and the sum of the remaining terms, after the *n* terms are taken away, is a square.

200. BY R. J. ADCOCK. — Prove that the locus of points, which have the sum of the squares of their distances from fixed points constant, is the surface of a sphere.

201. BY PROF. ASAPH HALL.—Given

$$x = a \cos A \pm r_1,$$
$$y = a \sin A \pm r_2,$$

where r_1 and r_2 are the probable errors of x and y. Required the probable errors of a and A.

QUERY, BY CHRISTINE LADD.—Which of the two following statements is correct?

"The point $x'y'z'$ is a multiple point of the order k, if all the differential coefficients of the order $k-1$ vanish for that point." (Salmon, *Higher Plane Curves*, Art. 73.)

"Il s'ensuit que, pour un point multiple de l'ordre n, il est *ne'cessaire, mais non suffisant*, que les de'rive'es partielles de la fonction f des ordres infe'rieurs a' n s'annulent tontes pour les co-ordonne'es du point m." (Serret, *Calcul. Diffe'rential*, Art. 186.)

PUBLICATIONS RECEIVED.

The National Quarterly Review. (Jan., 1878.) DAVID A. GORTON & Co., Publishers, N. Y. Besides the vigorous and scholarly literary articles which this periodical usually contains, this No. contains an interesting review of *The Progress of Modern Astronomy.*

The Mathematical Visitor, No. 2. ARTEMAS MARTIN, M. A., Editor and Publisher, Erie, Pa. 4to. 38 pp. This is an *annual* publication, devoted exclusively to the solution of problems, and contains a variety of problems, and many elegant solutions. Price 50 cts.

ERRATA.

On page 161 (Vol. IV), line 15, for $\theta', \theta'', \theta'''$, read $\theta^{0}, \theta^{00}, \theta^{000}$.
" " " " 2, from bottom, for 48, at end of line, read 54.
" " 162, " 5, read $A = \frac{2}{1+b} \cdot \frac{2}{1+b^{0}} \cdot \frac{2}{1+b^{00}} = \left[\frac{2}{\sqrt[4]{b} + \cos\frac{1}{2}\phi} \right]^2$.
" " " " 14, for $\sqrt{(1+e^2\sin^2\theta)}$, read $\sqrt{(1-e^2\sin^2\theta)}$.
" " 7 (Vol. V), " 12, for thirty, read sixty.
" " " " 15, for tables, read totals.
" " 9, " 3, from bottom, for $\triangle d\psi$, read $A\triangle d\psi$.
" " 11, " 3, " " for $\sqrt{b}.\sin\theta$, read $\sqrt{b}.\tan\theta$.
" " 15, " 3, for the factor $2\pi \div A$, read $4 \div A$.
" " 47, " 8, for ψ, read ϕ.
" " " line 22, for $(\cot a \cot b)(\cot x_1 \cot b)$, read $(\cot a + \cot b)(\cot x_1 + \cot b)$.
" " 48, in (20), for $\pm p$ read $\mp p$, and in (21), for $\pm p_1$, read, $\mp p_1$.
" " 53, line 1, for e', read e_1, and in line 4, from bot., for $1-a^2$, read $1+a^2$.